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Vegetation Inventory and Rare Plant Survey of Devonshire Beach—Lesser Slave Lake Provincial Park

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Vegetation Inventory and Rare Plant Survey of Devonshire Beach - Lesser Slave Lake Provincial Park

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Executive Summary

During the spring and summer of 2004 Geowest Environmental Consultants (Geowest) completed a biophysical inventory of the Devonshire Beach area for Alberta Community Development, Parks and Protected Areas Division (Client). The study was designed to collect field data and review existing literature on the Devonshire Beach study area in order to provide background materials in support of the development of a management plan for Devonshire Beach. The community of Slave Lake, the Municipal District of Lesser Slave River #124, and other stakeholders were consulted during this process.

This biophysical study has been structured into two components, the Beach Ridge Significance Study, and the Vegetation Inventory and Rare Plant Survey. Both components are closely linked, as the vegetation growing in the area is influenced by the presence of the beach ridge, and the development of the sand dune is influenced by the vegetation.

The main objectives of the vegetation inventory and rare plant survey include:

- Completing an inventory of plant species in the study area including vascular plants, mosses and liverworts;
- Conducting a survey for the presence of rare and unusual species on Devonshire Beach; and
- Evaluating the vegetation reclamation plots along the beach ridge.

This report details the findings of the vegetation inventory and rare plant study.

The identification of Sitka willow (*Salix sitchensis*) on Devonshire Beach by Dr. George Argus and Joyce Gould in 2003 indicated the need for a rare plant survey of this unique habitat. Sitka willow is rare in Alberta and is ranked S1 by the Alberta Natural Heritage Information Centre (ANHIC)(Vujnovic and Gould 2002). The population on Devonshire Beach represents one of only two known locations in Alberta for this species; the other record being from the Whitecourt area in 1968 (ANHIC files 2004).

A literature search was completed to locate references relating to Lesser Slave Lake Provincial Park and sand dune communities in northern Alberta. Field surveys were conducted three times during the months of May through August 2004. Field crews performed a reconnaissance survey of the study area and defined three main habitat types; (1) forested partially stabilized dune and slope, (2) lower slope active sand, and (3) beach habitats. The vegetation inventory and rare plant surveys were conducted by using a random meander walk within each habitat type and compiling a species list until no new species were found. A total of 193 vascular plant, moss and liverwort species were encountered during the three site visits to Devonshire Beach. Three rare species were observed, including a likely observation of the Sitka willow (*Salix sitchensis*) ranked S1 by ANHIC, a confirmed population of fox sedge (*Carex vulpinoidea*) along the shoreline of Lesser Slave Lake (ranked S2) and a patch of *Campylium hispidulum* (false willow moss) ranked S3. A number of invasive species were found including three noxious weeds (under the Alberta Weed Act), five nuisance weed species, six non-native species considered by the Alberta Native Plant Council to be invasive and five non-native species likely introduced through past reclamation efforts. One unusual grass species was encountered, however the identification is not entirely certain.

During the early 1970's, it became evident that Devonshire Beach and the associated beach ridge in Lesser Slave Lake Provincial Park were extensively disturbed by recreational over-use and sand excavation for highway construction. Consequently, portions of the beach ridge system were completely denuded of native vegetation, causing sand to shift eastward from Lesser Slave Lake (Lesko 1974). A major reclamation program was initiated in 1973, which attempted to mechanically stabilize sand on the beach ridge and re-establish vegetation to ensure that sand

movement was minimized. A second evaluation of reclamation on the beach ridge was conducted in 1996 as part of a horticultural plan for the Big Lake Discovery Centre (BKA 1996).

The 1973 and 1996 reclamation efforts were re-evaluated as part of the 2004 field program. During the field surveys, several sections of wood-lathe snow fencing were encountered, primarily in the southern portion of Devonshire Beach. Sand movement was evident around all portions of the fencing although vegetation was also present. Many of the species observed were species native to Alberta, however certain species are more common in the southern portion of the province. The 1996 reclamation site was investigated thoroughly, however it was difficult to determine where the reclamation plot ended and where the natural beach ridge began. While the snow fence was evident, the use of native species in reclamation attempts made determining the extents of the reclamation plot difficult.

As a result of the literature review and field surveys, several recommendations are proposed, including:

1. Invasive Species Monitoring / Vegetation Management Program
2. Additional Rare Plant / Rare Community Surveys
3. Dedicated Non-vascular / Bryophyte Survey
4. Rare Species Monitoring Program
5. Surveys on Leeward Side of Dune / Wetland Complex
6. Formal Re-vegetation Program

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1.0 Introduction

1.1 Project Description

Alberta Community Development, Parks and Protected Areas Division, is preparing a management plan for Devonshire Beach along with the community of Slave Lake, the Municipal District of Lesser Slave River #124, and other stakeholders. Alberta Community Development, Parks and Protected Areas, retained Geowest Environmental Consultants to conduct two biophysical studies for Devonshire Beach including:

- An assessment of the beach ridge to determine its level of significance and disturbance, and
- A vegetation inventory and rare plant survey.

This report addresses the vegetation inventory and rare plant survey.

The identification of Sitka willow (*Salix sitchensis*) on Devonshire Beach by Dr. George Argus and Joyce Gould in 2003 has indicated the need for a more comprehensive rare plant survey of this unique habitat. Sitka willow is rare in Alberta and is ranked S1 by the Alberta Natural Heritage Information Centre (ANHIC) (Vujnovic and Gould 2002). The population on Devonshire Beach represents one of only two known locations in Alberta for this species; the other record being from the Whitecourt area in 1968 (ANHIC files 2004). The extent of this willow on the beach is unknown, and it is also unknown if other rare or unusual species exist here.

1.2 Objectives

The main objectives of the vegetation inventory and rare plant survey include:

- Completing an inventory of plant species in the study area including vascular plants, mosses and liverworts;
- Conducting a survey for the presence of rare and unusual species on Devonshire Beach. Rare species are those on the ANHIC tracking and watch lists. Unusual species include disjunct populations, those at the edge of their range, and regionally uncommon species; and
- Evaluating the vegetation reclamation plot along the beach ridge.

The results of this study may provide information for the preparation of the Devonshire Beach management plan.

1.3 Study Area Description

Devonshire Beach is found within Lesser Slave Lake Provincial Park, situated on the eastern edge of Lesser Slave Lake. Lesser Slave Lake is the largest accessible lake in Alberta, located approximately 250 km northwest of Edmonton. The park was established in 1966.

The Devonshire Beach study area is situated within the Dry Mixedwood Natural Subregion of Alberta. Aspen, balsam poplar, white birch, white spruce and balsam fir dominate typical upland sites in the Dry Mixedwood with mixedwood stands being most common. Beaked hazelnut, low-

bush cranberry, prickly rose, green alder, bunchberry, wild sarsaparilla and dewberry are common understory species. Dry and sandy sites are typically dominated by jack pine. Black spruce and tamarack tend to dominate forested wetland areas (Beckingham and Archibald 1996).

A previous biophysical inventory and resource assessment of Lesser Slave Lake Provincial Park (Bradley 1980) identified Devonshire Beach and the beach ridge / sand dune / wetland complexes as significant natural features. Both were identified as unique habitats and features of provincial significance.

'The beach ridge and sand dunes within the park combined with the series of ancient beach ridges and large wetlands adjacent to the southern end of the park are a provincially significant geomorphic and biological resource. The complex represents successive post-glacial shorelines and the isolation and infilling of a large bay of Lesser Slave Lake.' (Bradley 1980)

Widely fluctuating water levels are considered important in maintaining the fine sand beaches at the east end of the lake, including Devonshire Beach. The combination of high water levels and high-energy storms contribute large amounts of sand from headlands into the longshore drift that is later deposited on the beaches (Bradley 1980). This process replenishes the beach sand, which is continually eroded by wind. Periodic high water levels also impede vegetation from establishing on the beaches (Bradley 1980).

2.0 Methodology

2.1 Literature review

A literature search was completed to locate references relating to Lesser Slave Lake Provincial Park and sand dune communities in northern Alberta. Elaine Nepstad of Alberta Community Development provided many useful references.

2.2 Plant Inventory and Rare Plant Survey

2.2.1 Background Information

Rare plant species are defined as species that exist in small numbers or have a limited global or provincial distribution, either due to biological characteristics or other reasons (Lancaster 2000). ANHIC ranks, maps and tracks rare plants that are found in Alberta (Vujnovic and Gould 2002). A description of ANHIC rankings is presented in Table 1. For the objectives of this study, a ranking of "rare" refers to ANHIC definitions; specifically S1, S2, and occasionally S3 species. Some species are given a combined rank (i.e., S2/S3) to reflect uncertainty in their status.

Table 1. Alberta Natural Heritage Information Centre (ANHIC) Rankings.

Provincial Rank	Definition
S1	Five or less recorded occurrences, or with few individuals remaining.
S2	Six to twenty occurrences or with many individuals in fewer occurrences.
S3	Twenty-one to one hundred occurrences and may be rare and local throughout its range, or its range may be restricted (may be abundant at some locations or may be vulnerable to extirpation because of some factor of its biology).
S4	Secure under present conditions and typically with greater than one hundred occurrences or may be fewer with many large populations. May also be rare in parts of its range, especially at the periphery.
S5	Secure under present conditions with greater than one hundred occurrences but may be rare in part of its range, especially the periphery.

Source: Vujnovic and Gould 2002

Species with S1 to S2/S3 are included on ANHIC's 'tracking list'. The ANHIC 'watch list' includes species not present on the tracking list, but for which additional information is desired. Species included on watch lists generally have S3 and S3/S4 ranks and are typically species with a restricted distribution within Alberta, but are common within their range. Consequently, any observed declines in population numbers can result in the movement of a species from the watch to the tracking list (Vujnovic and Gould 2002).

Prior to the field survey program, botanists obtained a list of rare vascular plants from ANHIC's tracking list within the Boreal Forest Natural Region. Although information on species that are likely to occur in the area had been developed, the full Tracking and Watch List for vascular plant species (Vujnovic and Gould 2002) was used for the surveys. Furthermore, ANHIC's database was queried to obtain known rare plant occurrences from the study area and from surrounding regions.

2.2.2 Vegetation and Rare Plant Field Survey Methods

The phenology or development of diagnostic floral characteristics for different plant species over the course of a growing season dictates that several surveys are required to positively identify the range of species that may be found in the study area (Lancaster 2000). This was essential for identifying the Sitka willow; catkins are required for the accurate identification of willow species and these are commonly produced prior to leaf flush. Table 2 provides the dates for each of the three rare plant / vegetation surveys that were completed by Geowest personnel.

Table 2. Devonshire beach vegetation survey dates.

Season	Survey Date
Spring	May 17 th and 18 th
Early Summer	June 25 th and 26 th
Late Summer	August 12 th

Field crews performed a reconnaissance survey of the study area and defined three main habitat types; (1) forested partially stabilized dune and slope, (2) lower slope active sand, and (3) beach habitats. The vegetation inventory and rare plant surveys were conducted by using a random meander walk within each habitat type and compiling a species list until no new species were found. Specimens requiring further examination or species confirmation were collected, with the exception of immature species where the seed heads or flowers required for identification to species level were unavailable or where plant populations were small (no more than 1 in 20) (Lancaster 2000). Taxonomic nomenclature follows Moss (1983) for common species and Vujnovic and Gould (2002) for rare plants. Jennifer Doubt, at the Devonian Botanical Garden, identified unknown mosses. Dorothy Fabian at the University of Alberta Vascular Plant Herbarium identified unknown vascular plants.

2.3 Non-Native, Invasives and Agronomic Species

Non-native and invasive plant species were noted as part of rare plant surveys. The general location and population sizes for non-native and invasive plant species were noted during the field surveys.

3.0 Results

3.1 Reclamation Plot Study

During the 1970's, it became evident that Devonshire Beach and the associated beach ridge in Lesser Slave Lake Provincial Park were extensively disturbed by recreational over-use and sand excavation for highway construction. Consequently, portions of the beach ridge system were completely denuded of native vegetation, causing sand to shift eastward from Lesser Slave Lake (Lesko 1974). A major reclamation program was initiated in 1973, which attempted to mechanically stabilize sand on the beach ridge and re-establish vegetation to ensure the sand movement was minimized. A second evaluation of reclamation on the beach ridge was conducted in 1996 as part of a horticultural plan for the Big Lake Discovery Centre (BKA and Turner 1996). The results of these are discussed below.

3.1.1 Literature Review

Lesser Slave Lake Provincial Parks' staff attempted to stabilize the open disturbed sand with snow fences installed parallel to the lakeshore. The fences helped to accumulate sand but did not stop sand movement entirely. The area was seeded with a mixture of seeds, as there was little information on sand dune reclamation in Alberta (Lesko 1974). Fourteen grass species, five legumes and five woody species were tested in four different topographic positions on the sand dunes. The grasses and legumes used in the reclamation trials are summarized in Table 3. Only four of the species used were native to Alberta, including *Agropyron dasystachyum*, *Festuca scabrella*, *Calamovilfa longifolia* and *Oryzopsis hymenoides*.

Table 3. Grass and legume species used in 1970's reclamation (after Lesko, 1974).

Species	Common Name
<i>Agropyron cristatum</i> (L.) Gaertn.	Fairway wheatgrass*
<i>Agropyron dasystachyum</i> (Hook.) Scrib.	Thick spike wheatgrass
<i>Agropyron trichophorum</i> (Link) Richt.	Pubescent wheatgrass*
<i>Agropyron desertorum</i> (Fisch.) Schult.	Nordan wheatgrass*
<i>Festuca rubra</i> L.	Red fescue*
<i>Festuca scabrella</i> Torr.	Rough fescue
<i>Festuca ovina</i> var. <i>duriuscula</i> A.Gray	Hard fescue*
<i>Festuca arundinacea</i> Schreb.	Alberta fescue*
<i>Lolium perenne</i> L.	Perennial ryegrass*
<i>Poa compressa</i> L.	Canada bluegrass*
<i>Poa glaucantha</i> Gaudin	Bluegrass*
<i>Calamovilfa longifolia</i> (Hook.) Scribn.	Prairie sandreed
<i>Oryzopsis hymenoides</i> (Roem. and Schult.) Ricker	Indian ricegrass
<i>Elymus junceus</i> Fisch.	Russian wild-rye*
<i>Melilotus</i> spp.	Sweet clover*
<i>Astragalus cicer</i> L.	Cicer milk vetch*
<i>Coronilla varia</i> L.	Crown vetch*
<i>Onobrychis sativa</i> Lam	Sainfoin*
<i>Lotus corniculatus</i> L.	Bird's Foot Trefoil*

* = Non-native plant species

Cuttings of willow (*Salix* spp.), sage (*Artemisia* spp.), saskatoon (*Amelanchier alnifolia*) and balsam poplar were also collected locally and planted in the reclamation areas. Transplanted saskatoon seedlings and *Artemisia* cuttings survived relatively well while poplar and willow cuttings performed poorly (Lesko 1974). The most successful grasses after a year of observation were Russian wild-rye (*Elymus junceus*), native sod clumps (*Elymus innovatus*) and nordan wheatgrass (*Agropyron desertorum*) (Lesko 1974).

A second evaluation of the reclamation plots was conducted in 1996 as part of a horticultural plan for the Big Lake Discovery Centre (BKA and Turner 1996). During this evaluation, the authors noted that sand deposits of up to 500 mm (20 inches) had been deposited around remnant snow fences along the beach. The authors suspected that the initial formation of the existing fore-dune deposits were directly related to the initial reclamation program (1971-1975) (BKA and Turner 1996). However, they felt that it was uncertain whether sand deposition resulted from debris and driftwood that was allowed to accumulate in those years or to the installed snow fence, which separated the beach from the vegetated region. Furthermore, they noted that slightly higher lake levels during this period may also have played a significant role in bringing sand deposits further in shore. Furthermore, agronomic and native grasses and legumes planted in the early 1970's were thought to have increased sand stability (BKA and Turner 1996).

The 1996 evaluation determined that a number of blowouts on the lakeside of the beach road had been successfully reclaimed. The authors noted that many transplants of trees and shrubs had established successfully in the previously disturbed areas while there had also been considerable natural encroachment. (BKA and Turner 1996). They noted that the Devonshire Beach lakeside vegetation was much denser than twenty-five years ago, likely due to several factors including higher average water table levels and the fertilization program that was implemented during the 1970's. The implementation of stairs and walkways and the day use parking lot was also thought have had an effect on reducing sand movement and erosion by focusing traffic on more durable substrates (BKA and Turner 1996).

The 1996 study also evaluated the use of native plant species for reclamation / re-vegetation along the beach ridge. An additional 2.4 metres of snow fence provided by Alberta Parks was installed at the bottom of the blowout located north of the central stairs (lake side). Twelve species of native plants common to the beach, fore dune and wash areas were transplanted in a moderate foot traffic area and are summarized in Table 4. The location also represented a relatively high sand movement / deposition area, being located at the foot of an old blowout (BKA and Turner 1996).

Table 4. Native plant species used in 1996 reclamation program (BKA and Turner 1996).

Species	Common Name
<i>Artemisia</i> spp.	Wormwood / sage
<i>Carex</i> spp.	Sedges
<i>Epilobium angustifolium</i>	Fireweed
<i>Equisetum arvense</i>	Common horsetail
<i>Populus balsamifera</i>	Balsam poplar
<i>Populus tremuloides</i>	Trembling aspen
<i>Prunus pensylvanica</i>	Chokecherry
<i>Rosa</i> spp.	Rose
<i>Rubus idaeus</i>	Wild red raspberry
<i>Salix exigua</i>	Sandbar willow
<i>Smilacina stellata</i>	Star-flowered Solomon's seal
<i>Solidago</i> spp.	Goldenrod

3.1.2 2004 Evaluation / Observations

The 1973 and 1996 reclamation efforts were re-evaluated as part of the 2004 field program. However, as neither the 1973 nor 1996 projects were accurately mapped or designated on the ground, only general sites could be visited and observations made. Should future reclamation or stabilization projects be undertaken, it would be useful to have either GPS coordinates of the location or air photos with marked site locations to provide more accurate data and observations.

During the field surveys, several sections of wood-lathe snow fencing were encountered, primarily in the southern portion of Devonshire Beach. Several of the snow fences were thought to be part of the 1970's redevelopment program, while the short section of snow fencing north of the central stairs was thought to be part of the 1996 reclamation program. Sand movement was evident around all portions of the fencing although vegetation was also present. Many of the species observed were species native to Alberta, however certain species are more common in the southern portion of the province, in mixedgrass prairie regions. For example, Indian rice grass (*Oryzopsis hymenoides*) and sand grass (*Calamovilfa longifolia*) are grass species that typically occur in open sand in grassland regions of southern Alberta. These species were introduced as part of the 1973 reclamation program and persist to this day. Smaller amounts of rough fescue (*Festuca scabrella*) were also encountered; however, this species was not as prevalent as the Indian rice grass or the sand grass. Crested wheat-grass (*Agropyron pectiniforme* / *crisatum*) was found to be locally abundant in several old blowout sites, however its distribution was fairly limited. The only other introduced species used for reclamation that were encountered during the surveys were sweet clover (*Melilotus alba* and *Melilotus officinale*), sheep fescue (*Festuca ovina*) and Cicer's milkvetch (*Astragalus cicer*). Both the sweet clover and milkvetch were found in greatest covers along the beach ridge road. The sweet clover was also found in blowout areas and further downslope from the road, while the milkvetch rarely was found more than 2-3 metres away from the road. Sheep fescue was found in a variety of habitats, but it reached its greatest cover along the west-facing beach ridge slope adjacent to more open, former blowout sites. In these sites, sheep fescue often forms a fairly uniform cover, reducing the amount of exposed sand at the ground surface, while the sweet clover and milkvetch was found growing in relatively open exposed sand (i.e. sand ground cover > 50%).

The 1996 reclamation site was investigated thoroughly, however it was difficult to determine where the reclamation plot ended and where the natural beach ridge began. While the snow fence was evident, the use of native species in reclamation attempts made determining the extents of the reclamation plot difficult. A greater percentage of exposed sand was evident around the snow fence although this gradually decreased to both the north and south where vegetation covered higher percentages of the ground. However, species found in the blowout area were quite similar to the surrounding natural vegetation although the occasional species mentioned in reclamation reports (i.e. *Artemisia campestris*, *Oryzopsis hymenoides*) were encountered. Aspen seedlings, chokecherry, star-flowering Solomon's seal, raspberry and hay sedge were all observed in the reclamation plot vicinity.

3.2 Inventory of Plant Species

A total of 193 vascular plant, moss and liverwort species were encountered during the three site visits to Devonshire Beach. Three rare species were observed, including a likely observation of the Sitka willow (*Salix sitchensis*) ranked S1 by ANHIC, a confirmed population of fox sedge (*Carex vulpinoidea*) along the shoreline of Lesser Slave Lake (ranked S2) and a patch of *Campyllum hispidulum* (false willow moss) ranked S3. A number of invasive species were found including three noxious weeds (under the Alberta Weed Act), five nuisance weed species, six non-native species considered by the Alberta Native Plant Council to be invasive and five non-native species likely introduced through past reclamation efforts. One unusual grass species was encountered, however the identification is not certain. These findings are discussed in further details in the following sections.

3.2.1 List of plant species

A complete list of plant species is provided in Table 5. Taxonomic nomenclature follows Moss (1983) with common names following Alberta Energy (1990). Appendix 1 provides a listing of the plant species by habitat type.

Table 5. Complete list of plant species from the 2004 biophysical inventory.

SCIENTIFIC NAME	COMMON NAME
<i>Abies balsamea</i> ((L.) Mill)	Balsam fir
<i>Achillea millefolium</i> (L.)	Common yarrow
<i>Achillea sibirica</i> (Ledeb.)	Many-flowered yarrow
<i>Actaea rubra</i> ((Ait.) Willd.)	Red and white baneberry
<i>Agropyron pectiniforme</i> (R. & S.)	Crested-wheat grass
<i>Agropyron repens</i> ((L.) Beauv.)	Quack grass
<i>Agrostis scabra</i> (Willd.)	hair grass
<i>Agropyron smithii</i> (Rydb.)	Western wheat grass
<i>Agrostis stolonifera</i> (L.)	Redtop
<i>Agropyron trachycaulum</i> var. <i>subsecundum</i>	Bearded wheat grass
<i>Alnus tenuifolia</i> (Nutt.)	River alder
<i>Alopecurus aequalis</i> (Sobol.)	Water foxtail
<i>Amblystegium serpens</i>	Moss
<i>Amelanchier alnifolia</i> (Nutt)	Saskatoon
<i>Anemone canadensis</i> (L.)	Canada anemone
<i>Anemone multifida</i> (Poir.)	Cut-leaf anemone
<i>Apocynum androsaemifolium</i> (L.)	Spreading dogbane
<i>Arabis glabra</i> ((L.) Bernh.)	Tower mustard
<i>Aralia nudicaulis</i> (L.)	Wild sarsaparilla
<i>Arctostaphylos uva-ursi</i> ((L.) Spreng.)	Common bearberry
<i>Artemisia campestris</i> (L.)	Plains wormwood
<i>Artemisia frigida</i> (Willd.)	Pasture sagewort
<i>Aster ciliolatus</i> (Lindl.)	Lindley's aster
<i>Aster hesperius</i> (A. Gray)	Western willow aster
<i>Aster puniceus</i> (L.)	Purple-stemmed aster
<i>Astragalus cicer</i> (L.)	Cicer milk vetch
<i>Beckmannia syzigachne</i> ((Steud.) Fern.)	Slough grass
<i>Betula papyrifera</i> (Marsh.)	White birch

SCIENTIFIC NAME	COMMON NAME
<i>Brachythecium campestre</i>	Moss
<i>Brachythecium salebrosum</i>	Moss
<i>Bromus ciliatus</i> (L.)	Fringed brome
<i>Bromus inermis</i> var. <i>inermis</i>	Awnless brome
<i>Bryohaplocladium microphyllum</i>	Moss
<i>Bryum pseudotriquetrum</i>	Moss
<i>Bryum</i> spp.	Moss
<i>Calamagrostis canadensis</i> ((Michx.) Beauv.)	Bluejoint
<i>Calamagrostis inexpansa</i> (A. Gray)	Northern reed grass
<i>Calamovilfa longifolia</i> (Hook.) Scribn.	Sand grass
<i>Campylium hispidulum</i>	Moss
<i>Campanula rotundifolia</i> (L.)	Harebell
<i>Cardamine pensylvanica</i> (Muhl)	Bitter cress
<i>Carex bebbii</i> (Olney ex Fern.)	Bebb's sedge
<i>Carex curta</i> (Good.)	Short sedge
<i>Carex deweyana</i> (Schwein)	Dewey's sedge
<i>Carex filifolia</i> (Nutt.)	Thread-leaved sedge
<i>Carex siccata</i> (Dewey)	Hay sedge
<i>Carex vulpinoidea</i> (Michx.)	Fox sedge
<i>Carex utriculata</i> (Boott.)	Beaked sedge
<i>Ceratodon purpureus</i> ((Hedw.) Brid.)	Moss
<i>Chenopodium album</i> (L.)	Lamb's quarters
<i>Cicuta maculata</i> (L.)	Water hemlock
<i>Cirsium arvense</i> ((L.) Scop.)	Canada thistle
<i>Climacium dendroides</i> ((Hedw.) Web & Mohr.)	Tree Moss
<i>Comandra umbellata</i> ((L.) Nutt.)	Bastard toad-flax
<i>Conocephalum conicum</i> ((L.) Lindb)	Liverwort
<i>Corispermum nitidum</i> (Kit.)	Bugseed
<i>Cornus canadensis</i> (L.)	Bunchberry
<i>Cornus stolonifera</i> (Michx.)	Red-osier dogwood
<i>Corylus cornuta</i> (Marsh.)	Beaked hazelnut
<i>Crepis tectorum</i> (L.)	Annual hawk's beard
<i>Dactylis glomerata</i> (L.)	Orchard grass
<i>Disporum trachycarpum</i> ((S. Wats.) B.&H.)	Fairybells
<i>Drepanocladus aduncus</i> ((Hedw.) Warnst.)	Brown Moss
<i>Drepanocladus uncinatus</i> ((Hedw.) Warnst.)	Brown Moss
<i>Eleocharis acicularis</i> ((L.) R. & S.)	Needle spikerush
<i>Eleocharis palustis</i> ((L.) R. & S.)	Creeping spikerush
<i>Elymus innovatus</i> (Beal.)	Hairy wild rye
<i>Elymus piperi</i> (Bowden)	Giant wild rye
<i>Epilobium angustifolium</i> (L.)	Common fireweed
<i>Epilobium palustre</i> (L.)	Marsh willowherb
<i>Equisetum arvense</i> (L.)	Common horsetail
<i>Equisetum fluviatile</i> (L.)	Swamp horsetail
<i>Equisetum hyemale</i> (L.)	Common scouring-rush
<i>Equisetum pratense</i> (Ehrh.)	Meadow horsetail
<i>Erysimum cheiranthoides</i> (L.)	Wormseed mustard

SCIENTIFIC NAME	COMMON NAME
<i>Eurhynchium pulchellum</i> ((Hedw.) Jenn.)	Moss
<i>Festuca ovina</i> (L.)	Sheep fescue
<i>Festuca saximontana</i> (Rydb.)	Rocky mountain fescue
<i>Festuca scabrella</i> (Torr.)	Rough fescue
<i>Fragaria virginiana</i> (Duchesne)	Wild strawberry
<i>Galeopsis tetrahit</i> (L.)	Hemp-nettle
<i>Galium boreale</i> (L.)	Northern bedstraw
<i>Galium trifidum</i> (L.)	Small bedstraw
<i>Galium triflorum</i> (Michx.)	Sweet-scented bedstraw
<i>Geocaulon lividum</i> ((Richards) Fern.)	Northern comandra
<i>Geum aleppicum</i> (Jacq.)	Yellow avens
<i>Geum rivale</i> (L.)	Purple avens
<i>Glyceria grandis</i> (S. Wats. ex A. Gray)	Common tall manna grass
<i>Glyceria striata</i> ((Lam.) A.S. Hitchc.)	Fowl manna grass
<i>Hieracium umbellatum</i> (L.)	Narrow leaved hawkweed
<i>Hordeum jubatum</i> (L.)	Foxtail barley
<i>Hylocomium splendens</i> ((Hedw.) B.S.G.)	Stair-step Moss
<i>Juncus alpinoarticulatus</i> (Chaix.)	Alpine rush
<i>Juncus balticus</i> (Willd.)	Wire rush
<i>Juncus nodosus</i> (L.)	Knotted rush
<i>Juniperus horizontalis</i> (Moench)	Creeping juniper
<i>Juniperus communis</i> (L.)	Ground juniper
<i>Kochia scoparia</i> ((L.) Schrad.)	Summer cypress
<i>Lathyrus ochroleucus</i> (Hook.)	Cream-colored vetchling
<i>Ledum groenlandicum</i> (Oeder.)	Common Labrador tea
<i>Leptobryum pyriforme</i>	Moss
<i>Linnaea borealis</i> (L.)	Twin-flower
<i>Lonicera dioica</i> (L.)	Twining honeysuckle
<i>Lonicera involucrata</i> ((Richards.) Banks)	Bracted honeysuckle
<i>Luzula multiflora</i> ((Retz.) Lej.)	Field woodrush
<i>Maianthemum canadense</i> (Desf.)	Wild lily-of-the-valley
<i>Medicago sativa</i> (L.)	Alfalfa
<i>Melilotus alba</i> (Desr.)	White sweet-clover
<i>Melilotus officinalis</i> ((L.) Lam.)	Yellow sweet clover
<i>Mentha arvensis</i> (L.)	Wild mint
<i>Mertensia paniculata</i> ((Ait.) G.Don)	Large-flowered lungwort
<i>Mitella nuda</i> (L.)	Bishop's-cap
<i>Mnium spinulosum</i>	Moss
<i>Moehringia lateriflora</i> ((L.) Fenzl.)	Blunt-leaved sandwort
<i>Orthilia secunda</i> ((L.) House)	One-sided wintergreen
<i>Oryzopsis asperifolia</i> (Michx.)	White-grained mountain rice grass
<i>Oryzopsis hymenoides</i> ((R.&S.) Ricker)	Indian rice grass
<i>Oryzopsis pungens</i> ((Torr.) A.S.Hitchc.)	Northern rice grass
<i>Petasites palmatus</i> ((Ait.) A.Gray)	Palmate-leaved coltsfoot
<i>Petasites sagittatus</i> ((Pursh) A.Gray)	Arrow-leaved coltsfoot
<i>Phalaris arundinacea</i> (L.)	Reed canary grass
<i>Phleum pratense</i> (L.)	Timothy

SCIENTIFIC NAME	COMMON NAME
<i>Picea glauca</i> ((Moench) Voss)	White spruce
<i>Pinus banksiana</i> (Lamb.)	Jack pine
<i>Pinus sylvestris</i> var. <i>syvestris</i> (L.)	Scot's pine
<i>Plagiomnium cuspidatum</i> ((Hedw.) Kop.)	Moss
<i>Plantago major</i> (L.)	Common plantain
<i>Pleurozium schreberi</i> ((Brid.) Mitt.)	Schreber's Moss
<i>Poa palustris</i> (L.)	Fowl bluegrass
<i>Poa pratensis</i> (L.)	Kentucky bluegrass
<i>Pohlia nutans</i> ((Hedw.) Lindb.)	Copper wire moss
<i>Pohlia wahlenbergii</i> ((Web.&Mohr) Andr.)	Moss
<i>Polytrichum juniperum</i> (Hedw.)	Juniper haircap
<i>Polygonum lapathifolium</i> (L.)	Pale persicaria
<i>Polytrichum piliferum</i> (Hedw.)	Awned haircap
<i>Populus balsamifera</i> (L.)	Balsam poplar
<i>Populus tremuloides</i> (Michx.)	Aspen
<i>Potentilla anserina</i> (L.)	Silverweed
<i>Potentilla fruticosa</i> (L.)	Shrubby cinquefoil
<i>Potentilla norvegica</i> (L.)	Rough cinquefoil
<i>Prunus pensylvanica</i> (L. f.)	Pin cherry
<i>Prunus virginiana</i> (L.)	Choke cherry
<i>Pylaisiella polyantha</i> ((Hedw.) Grout)	Moss
<i>Pyrola asarifolia</i> (Michx.)	Common pink wintergreen
<i>Rhytidium rugosum</i> ((Hedw.) Kindb.)	Pipecleaner moss
<i>Ribes oxycanthoides</i> (L.)	Northern gooseberry
<i>Ribes triste</i> (Pall.)	Wild red currant
<i>Rosa acicularis</i> (Lindl.)	Prickly rose
<i>Rosa woodsii</i> (Lindl.)	Common wild rose
<i>Rubus idaeus</i> (L.)	Wild red raspberry
<i>Rubus pubescens</i> (Raf.)	Dewberry
<i>Rumex occidentalis</i> (S.Wats)	Western dock
<i>Salix arbusculoides</i> (Anderss.)	Shrubby willow
<i>Salix bebbiana</i> (Sarg.)	Beaked willow
<i>Salix boothii</i> (Dorn)	Booth's willow
<i>Salix candida</i> (Fleugge ex Willd)	Hoary willow
<i>Salix drummondiana</i> (Barr. ex. Hook)	Satin willow
<i>Salix exigua</i> (L.)	Sandbar willow
<i>Salix lasiandra</i> (Benth.)	Western shining willow
<i>Salix petiolaris</i> (J.E. Smith)	Basket willow
<i>Salix planifolia</i> (Pursh)	Flat leaved willow
<i>Salix prolixa</i> (Anderss.)	Mackenzie's willow
<i>Salix serissima</i> ((Bailey) Fern.)	Autumn willow
<i>Salix sitchensis</i> (Sanson ex Bong.)	Sitka willow
<i>Schizachne purpurascens</i> ((Torr.) Swallen)	Purple oat grass
<i>Scirpus microcarpus</i> (Presl)	Small fruited bulrush
<i>Scirpus validus</i> (Vahl)	Common great bulrush
<i>Scutellaria galericulata</i> (L.)	Marsh skullcap
<i>Silene cucubalus</i> (Wibel)	Bladder campion

SCIENTIFIC NAME	COMMON NAME
<i>Silene noctiflora</i> (L.)	Night-flowering catchfly
<i>Sisyrinchium montanum</i> (Greene)	Common blue-eyed grass
<i>Smilacina stellata</i> (L.) Desf.)	Star-flowered Solomon's seal
<i>Solidago canadensis</i> (L.)	Canada goldenrod
<i>Solidago graminifolia</i> (L.) Salisb.	Flat-topped goldenrod
<i>Stellaria longifolia</i> (Muhl.)	Long-leaved chickweed
<i>Symphoricarpos albus</i> ((L.) Blake)	Snowberry
<i>Syntrichia ruralis</i>	Moss
<i>Taraxacum officinale</i> (Weber)	Dandelion
<i>Tetraphis pellucida</i> (Hedw.)	Moss
<i>Thalictrum venulosum</i> (Trem.)	Veiny meadow rue
<i>Thuidium abietinum</i> ((Hedw.) B.S.G.)	Moss
<i>Tortula mucronifolia</i>	Moss
<i>Trientalis borealis</i> (Raf.)	Northern starflower
<i>Trifolium hybridum</i> (L.)	Alsike clover
<i>Trifolium pratense</i> (L.)	Red clover
<i>Trifolium repens</i> (L.)	White clover
<i>Typha latifolia</i> (L.)	Common cattail
<i>Urtica dioica</i> (L.)	Common nettle
<i>Vaccinium myrtilloides</i> (Michx.)	Blueberry
<i>Vaccinium vitis-idaea</i> (L.)	Bog cranberry
<i>Viburnum edule</i> ((Michx.) Raf.)	Low-bush cranberry
<i>Vicia americana</i> (Muhl.)	American vetch
<i>Viola adunca</i> (J.E. Smith)	Early blue violet

3.2.2 List and discussion of non-native plant species

Three noxious weeds were found in the Devonshire Beach study area, highlighted in orange in Table 6; spreading dogbane (*Apocynum androsaemifolium*), Canada thistle (*Cirsium arvense*) and bladder campion (*Silene cucubalus*). Canada thistle was found near the shoreline of Lesser Slave Lake, between the shoreline and the willow thickets west of the walking trail that runs south from the North Shore Day-use area. Several large patches (covering up to 10-15 square metres) were found near willow thickets and Canada thistle formed the dominant ground cover in these sites. Only occasional bladder campion plants were found along the toe slope of the beach ridge and occasionally along the shoreline. Bladder campion was definitely the least common noxious weed found at Devonshire Beach.

Spreading dogbane was found along the walking trail that runs south of the North Shore Day-use area. Several patches were found along the walking trail where spreading dogbane was the dominant species, although it generally occurred sporadically with relatively low percent covers. Although this species is classified as a noxious weed under the Alberta Weed Act (Province of Alberta n.d.), it is a native species to the province. This species is known for its ability to spread rapidly and its potential toxicity to livestock (Tannas 2004; Royer and Dickenson 1999), which may cause problems in agricultural areas. However, it has also been noted that spreading dogbane may be effective in reclamation due to the soil binding abilities of the plant's rhizomes (Tannas 2004).

Five nuisance weeds (highlighted yellow in Table 6) were found sporadically throughout the Devonshire Beach study area. Quack grass (*Agropyron repens*) was found occasionally along the west-facing slope of the beach ridge near the groomed beach. Quack grass never formed a large

component of the ground cover, but it was a noticeable species. Annual hawkweed (*Crepis tectorum*) occurred sporadically near the beach ridge road and occasionally near the base of the beach ridge. Only individual scattered plants were found. Fewer than five hemp-nettle (*Galeopsis tetrahit*) plants were found along the beach, near shoreline, approximately halfway between the groomed beach and the North Shore Day-use area. Dandelion was found in basically all habitat types at Devonshire beach, from beach habitats to more forested sites; however, it occurred only sporadically and never formed a major component of the ground cover.

Populations of rough cinquefoil were also found along the beach in several locations approximately 10-15 metres from shoreline. Generally, between two to ten plants would be found although the odd individual plant could also be found. This species was generally found in the un-groomed portions of the beach. Although this species is classified as a nuisance weed under the Alberta Weed Act (Province of Alberta n.d.), it is also a native species in Alberta. This species is known to be an increaser that requires exposed soil to become established (Tannas 2004; Royer and Dickenson 1999), which may pose problems in agricultural areas. However, it is known to occur naturally in the region (Moss 1983) and has also been recognized as an effective soil stabilizer (Tannas 2004).

Table 6. Non-native, invasive and designated weed species found in the Devonshire Beach study area.

SCIENTIFIC NAME	COMMON NAME	STATUS
<i>Agropyron pectiniforme</i> (R. & S.)	Crested-wheat grass	Non-native (ANPC - invasive)
<i>Agropyron repens</i> (L.) Beauv.)	Quack grass	Nuisance weed
<i>Agrostis stolonifera</i> (L.)	Redtop	Non-native
<i>Apocynum androsaemifolium</i> (L.)	Spreading dogbane	Noxious weed (Native)
<i>Astragalus cicer</i> (L.)	Cicer milk vetch	Non-native
<i>Bromus inermis</i> var. <i>inermis</i>	Awnless brome	Non-native (ANPC - invasive)
<i>Cirsium arvense</i> (L.) Scop.)	Canada thistle	Noxious weed
<i>Crepis tectorum</i> (L.)	Annual hawk's beard	Nuisance weed
<i>Festuca ovina</i> (L.)	Sheep fescue	Non-native
<i>Galeopsis tetrahit</i> (L.)	Hemp-nettle	Nuisance weed
<i>Medicago sativa</i> (L.)	Alfalfa	Non-native
<i>Melilotus alba</i> (Desr.)	White sweet-clover	Non-native (ANPC - invasive)
<i>Melilotus officinalis</i> (L.) Lam.)	Yellow sweet clover	Non-native (ANPC - invasive)
<i>Phleum pratense</i> (L.)	Timothy	Non-native (ANPC - invasive)
<i>Pinus sylvestris</i> var. <i>syvestris</i> (L.)	Scot's pine	Non-native
<i>Poa pratensis</i> (L.)	Kentucky bluegrass	Non-native (ANPC - invasive)
<i>Potentilla norvegica</i> (L.)	Rough cinquefoil	Nuisance weed (Native)
<i>Silene cucubalus</i> (Wibel)	Bladder campion	Noxious weed
<i>Taraxacum officinale</i> (Weber)	Dandelion	Nuisance weed

The remainder of the species listed in Table 6 are non-native species to Alberta. Some of the species are considered to be invasive by a number of sources (ANPC 2000), which could be an issue to maintaining the ecological integrity of the plant communities found in the Devonshire Beach study area. A number of these species were introduced to the area through the past reclamation programs which sought to reduce sand movement by increasing vegetative cover on patches of open sand. A monitoring program might be valuable, to ensure that these species do not out-compete native species causing a shift in native plant community species composition.

3.2.3 Rare and unusual plant survey

Potentially two rare species were observed during the vegetation surveys of Devonshire Beach, including a likely observation of the Sitka willow (*Salix sitchensis*) ranked S1 by ANHIC, and a confirmed population of fox sedge (*Carex vulpinoidea*) along the shoreline of Lesser Slave Lake (ranked S2). The locations of these populations are provided in Appendix 2.

Dr. George Argus and Joyce Gould identified Sitka willow (*Salix sitchensis*) on Devonshire Beach in 2003. Dr. George Argus is a recognized expert in willow taxonomy and an Honorary Appointee of the Canadian Museum of Nature, upon his retirement from this institution. Joyce Gould is a botanist with the Alberta Natural Heritage Information Centre ANHIC). Sitka willow is ranked S1 by the ANHIC (Vujnovic and Gould 2002) indicating that five of fewer known populations of this species have been located in the province. In fact, the Devonshire Beach population may represent one of only two known locations in Alberta for this species; the other record being historical from the Whitecourt area in 1968 (ANHIC files 2004). Three attempts were made to re-locate the Sitka willow identified by George Argus and Joyce Gould. One Sitka willow shrub was possibly located on August 12th along the beach habitat. Two small branch specimens were collected for verification. While Dorothy Fabian (assistant curator of the University of Alberta Vascular Plant Herbarium) was relatively certain the leaves and branches collected were Sitka willow, she noted that catkins would be required for an absolute identification. Catkins were sought during all three field visits to the study area, however the timing was not such to capture the willow at time of flowering. A vegetative specimen will be sent to Dr. George Argus for expert identification.

A population of fox sedge (*Carex vulpinoidea*) was found along the shoreline of Lesser Slave Lake located approximately 500 – 700 metres south of the North Shore Day-use area. Approximately 40 – 60 small clumps of the fox sedge were found where it occurred in relatively open patches in a willow thicket and adjacent to wetter areas dominated by rushes, bulrushes and cattails. This species is noted to require non-saline, non-acid soils that are permanently wet but receive some drainage (Kershaw et al. 2001). This species is currently ranked S2 by ANHIC, indicating that between 6 and 20 occurrences of this species are known in the province (Vujnovic and Gould 2002).

In addition to the two rare species observations, one moss species, false willow moss (*Campylium hispidulum*) was found in one site mixed in a patch of various *Brachythecium* species. False willow moss is currently ranked S3 although it does not occur on either the ANHIC tracking or watch lists (ANHIC 2002). A ranking of S3 indicates that between 21 and 100 occurrences are known in the province and the species may be rare and local throughout its range or it may be restricted in its range.

Giant wild rye (*Elymus piperi*) was also possibly found along the beach ridge road, although the specimen collected differs from the known morphological characteristics of the lemmas. Dorothy Fabian identified one grass specimen to likely be giant wild rye. Giant wild rye is a robust species forming large clumps and often reaching 2 to 3 metres in height (Moss 1983). Ms. Fabian noted that on the specimen provided the lemma were hirsute which is not a typical characteristic; Moss (1983) notes that giant wild rye lemmas are typically thinly pubescent to glabrous. This species is generally known to occur south of the Red Deer River where it is relatively common in the southern prairies and foothills (Moss 1983; Tannas 2003). Tannas (2003) noted that giant wild rye was found in moist sites along river banks, shrubby coulees, moist snow melt slopes or around springs or seeps. It is also noted that giant wild rye received recognition for its extensive rooting system, which has excellent soil binding properties (Tannas 2003). Consequently, with its general southern distribution and soil binding root system, it is possible that this species might have been introduced to the Devonshire Beach ridge area to aid in sand stabilization. Although this species has not been noted in either of the reclamation reports (Lesko 1974, BKA and Turner 1996)

perhaps it was part of a seed mixture or part of an informal site reclamation program rather than a natural range extension.

4.0 Discussion

4.1 Site Evaluation

Devonshire Beach within Lesser Slave Lake Provincial Park has long been renowned for its extensive sandy beaches and easy accessibility. Bradley (1980) identified Devonshire Beach and the beach ridge / sand dune / wetland complexes as provincially significant natural features and as unique habitats. This survey identified over 190 vascular plant, moss and liverwort species within a 4.5 kilometre stretch of shoreline. The high diversity of this area reflects the variety of landscape features and intergrades between habitat types that creates a wealth of unique microhabitats. Rare plants are most commonly found associated with unique micro- or seasonal habitats, unusual landscape features and transitional areas. Sites where rare plants are found are typically related to substrate, seasonal water patterns, small-scale landscape features and particular plant associations (Lancaster 2000). As such, the Devonshire Beach area has a high potential to harbour rare plant species due to the range in microhabitats, unique landscape features and numerous transitional areas.

Past reclamation efforts have introduced a number of species not native to the province or to the Lesser Slave Lake region. Furthermore, due to the relatively high use of the area and past use of motorized vehicles along the shoreline, several noxious and nuisance weeds were found. Despite these non-native, invasive and potentially invasive species, their total extent is not widespread throughout the study area and can likely be monitored to ensure that further spread into relatively natural areas can be prevented.

4.2 Critique of Inventory Protocols

The identification of Sitka willow on Devonshire Beach by Dr. George Argus and Joyce Gould in 2003 was a major factor in doing a more focused vegetation inventory along the beach. The extent of this willow on the beach was unknown and a focal point of this survey was to re-locate the willow and determine its extent along the beach. Unfortunately, while this survey possibly re-located the original willow found in 2003 (pending verification of vegetative specimen), no additional plants were found. This was in part due to the surveyor's inability to obtain catkins from the willow at the time of flowering. Although surveys were initiated in May, this species was not found at the time of flowering due to a lack of familiarity with this species' flowering times in Alberta. While three surveys during the course of a growing season are typically sufficient to capture most species at critical times (i.e. of plant development), the timing of these surveys was obviously not adequate to capture this species at its time of flowering.

Joyce Gould surveyed a larger portion Devonshire Beach in June of 2004, including a revisit to the 2003 Sitka willow site. While she also found only vegetative plants, she collected specimens from a number of suspected willow plants located along the beach. A map of her results is provided in Appendix 3. The specimens she collected were sent to George Argus for expert identification, which he confirmed were Sitka willow (Nepstad pers. comm. 2004). Ms. Gould's survey of the beach will be invaluable in determining the extents of this species along Devonshire Beach.

While a bryologist (Jennifer Doubt) was available to identify non-vascular samples that were collected, she did not accompany the surveyors in the field during their inventory. Geowest field surveyors have some skill in identifying mosses and liverworts, however the focus of individuals involved in this project leans more towards vascular plant identification. It is difficult for non-bryologists to identify certain species, particularly in the field as a microscope is often required to

view diagnostic features. Furthermore, had a bryologist been involved in the field surveys, they would have been better able to identify potential habitats for rare non-vascular species.

4.3 Project Limitations

The study area covered for this project totaled approximately 60 - 65 hectares. While every reasonable effort was made to cover all the ground within the study area and create a complete species list, the list provided in this report is very likely incomplete. There are several factors that would influence the completeness of the species list, including the high diversity of the beach area, lack of a bryologist and general budgetary limitations. It should be also be noted that rare plant surveys can only confirm the presence of rare plants. Information from surveys in one year does not positively indicate that rare plants are absent from the survey area because flowering season may vary, distribution may be scattered, and some species may remain dormant in some years (Lancaster 2000).

While this study focused on a floristic inventory of the Devonshire Beach area, the leeward side of the primary dune and older dunes (outside of the park) were not included. These areas also represent unique micro- or seasonal habitats, unusual landscape features and transitional areas. As such, these areas would also have a high potential to harbour rare plant species due to the range in microhabitats, unique landscape features and numerous transitional areas.

4.4 General Observations

Invasive species are non-native plant species that once introduced into native habitats can not only survive but can also prosper. Invasive species have the potential to displace native plants by aggressive competition for resources, lack of co-evolved predators and pathogens, or even by direct chemical antagonism (alleopathy) against which native plants that did not co-evolve with them have no defense (ANPC 2000). Non-native invasive species can reduce biodiversity, essentially creating monocultures in undisturbed sites. Invasive species' ability to become established in native habitats impedes the objective of preserving native habitats, their inter-relationships among species and their evolved resiliency and adaptation to natural disturbance and climatic variation (ANPC 2000).

Invasive and non-native species introduced to the Devonshire Beach area through past reclamation efforts may pose a problem in the future. While it is likely not practical to institute a program to remove the non-native and invasive species present on Devonshire Beach, their further spread could be monitored. Nolan Turner noted in 1996 that:

Though maintaining a completely 'natural' resource composed of totally native species in the proper compositions and able to be influenced by natural successional trends is a commendable goal, it is unrealistic to expect that the present plant community structure of the primary dune system will support the anticipated volume and type of site visitation. The use of 'unnatural' elements, including hard landscaping, topsoil and the use of more tolerant (to foot traffic) native and agronomic plants that enhance site capability for use or that provide for quick resource repairs will need to be considered (BKA and Turner 1996).

The fragile and highly erodible nature of the sand dunes does require that some compromise in site maintenance, from public use and visitation, and ecological integrity be made.

5.0 Recommendations

Based on the high species diversity found at Devonshire Beach, the rare plant species found and the potential of the habitat to harbour rare plant species, several conservation / monitoring programs would be beneficial to maintain the high ecological integrity of area.

1. **Invasive Species Monitoring / Vegetation Management Program** – Invasive species could present a serious threat to the ecological integrity of the beach area. Numerous non-native and invasive species were introduced through past reclamation programs and pedestrian (and past vehicular) access to the area. As mentioned in section 4.4, invasive species can affect native community composition, reduce biodiversity and ultimately change the habitats present at Devonshire Beach. This would not only affect the dynamics of the plant communities themselves, but also the fauna that relies on these habitats in addition to the local first nations who have historically used these communities. An invasive species monitoring or vegetation management program to deal with these invasive species may be a worthwhile investment if maintaining ecological integrity is a high priority. This type of program should target only non-native and invasive species.
2. **Additional Rare Plant / Rare Community Surveys** - The high diversity of this area reflects the variety of landscape features and ecotonal areas between habitat types that creates a wealth of unique microhabitats. Rare plants are most commonly found associated with unique micro- or seasonal habitats, unusual landscape features and transitional areas, and as such Devonshire Beach has a high potential to harbour rare plant species. Potentially two rare tracked plants (S1 and S2) have been identified along the beach and beach ridge. Any additional Sitka willow populations should be identified and additional fox sedge populations may also exist along the beach. As such, future surveys along the beach, both within Lesser Slave Lake Provincial Park and outside the park boundaries, would be definitely beneficial to provide context for these rare plant populations.
3. **Dedicated Non-vascular / Bryophyte Survey** – While the field surveyors had some skill at non-vascular plant identification and were able to identify certain species in the field and collect unknowns for later identification, this is often not sufficient to fully describe the non-vascular species composition of an area and capture the full range of rare non-vascular species. A bryologist would have greater knowledge and experience to identify rare non-vascular species and their potential habitats in the field.
4. **Rare Species Monitoring Program** – Due to high levels of public use of the beach and beach ridge complex, a monitoring program for known rare plant species would be beneficial. This program, with particular regards to the Sitka willow, would help to monitor the status of known rare species on the beach and how public use impacts these plants. This program would be almost critical should additional portions of the beach be groomed for public use.
5. **Leeward Side of Dune / Wetland Complex** - Furthermore, future surveys should include the leeward side of the dune system and associated wetland complexes as these areas would also represent unique landscape features.
6. **Formal Re-vegetation Program** – The previous re-vegetation attempts and monitoring efforts have been a fairly informal process. In order to maintain the beach dune system as a landform, reducing sand movement in certain areas is desirable.

As such, a formal re-vegetation program could work towards this goal, through the installation and maintenance of snow fencing, to reduce sand movement, and seeding / transplanting of vegetation. The use of native Alberta species is recommended. An annual monitoring program would be beneficial for evaluating revegetation success.

6.0 Conclusion

Devonshire Beach is a unique landscape feature within Alberta and a major tourist attraction for the community of Lesser Slave Lake and Lesser Slave Lake Provincial Park. Although a number of human disturbances are present on the beach ridge, which likely cannot be reversed, the site is still relatively intact and is worthy of preservation. This survey identified over 190 vascular plant, moss and liverwort species within a 4.5 kilometre stretch of shoreline. The high diversity of this area reflects the variety of landscape features and ecotonal areas between habitat types that creates a wealth of unique microhabitats. Rare plants are most commonly found associated with unique micro- or seasonal habitats, unusual landscape features and transitional areas, and as such Devonshire Beach has a high potential to harbour rare plant species.

Two rare plants, Sitka willow (*Salix sitchensis*) and fox sedge (*Carex vulpinoidea*) were found. The Sitka willow represents only one of two known locations for this species in the province of Alberta, while only between 6 and 20 sites of the fox sedge are known.

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Personal Communications

Nepstad, Elaine. 2004. Elaine Nepstad is a Planning Officer with Alberta Community Development, Parks and Protected Areas, Grande Prairie, Alberta. Ms. Nepstad provided information on communications with and between Joyce Gould and Dr. George Argus.

Appendix 1 – Plant Species List by Habitat Type

VEGETATION DESCRIPTION - DEVONSHIRE BEACH

SURVEYORS: NT, VC

AGENCY: Geowest Environmental

DATE: May 17, June 23 2004, August 12

Plot Area: Beach

Species Code

Shrub	Forb	Grass/Sedge	Moss
ALNUTEN	ACHIMIL	AGROSCA	BRYUPSE
CORNSTO	ACHISIB	ALOPAEQ	BRYUSFP
PINUBAN	ANEMCAN	BECKSYZ	CERAPUR
POPUBAL	APOCAND	CALACAN	CONOCON
POPUTRE	ARTECAM	CALAINE	DREPADU
RUBUIDA	ASTEHES	CAREBEB	LEPTPYR
SALIBEB	ASTEPUN	CAREDEW	POHLWAH
SALIBOO	CARDPEN	CAREUTR	
SALICAN	CICUMAC	CAREVUL	
SALIDRU	CIRSARV	ELEOACI	
SALIEXI	CREPTEC	ELEOPAL	
SALILAS	EPILANG	GLYCGRA	
SALILUT	EPILPAL	GLYCSTR	
SALIPET	EQUIARV	HORDJUB	
SALIPLA	FRAGVIR	JUNCALP	
SALIPRO	GALETET	JUNCBAL	
SALISIT?	HIERUMB	JUNCNOD	
	KOCHSCO	LUZUMUL	
	LATHOCR	PHALARU	
	MELIALB	PHLEPRA	
	MELIOFF	POAPRA	
	MENTARV	SCIRLAC	
	PETASAG	SCIRMIC	
	PLANMAJ	TYPHLAT	
	POLYLAP		
	POTEANS		
	POTENOR		
	RUMEOCC		
	SCUTGAL		
	SILENOC		
	SISYMON		
	SOLICAN		
	SOLIGRA		
	TARAOFF		
	TRIFHYB		

TRIFREP
URTIDIO
VICIAME

VEGETATION DESCRIPTION - DEVONSHIRE BEACH

SURVEYORS: NT, VC

AGENCY: Geowest Environmental

DATE: May 17, June 23 2004, August 12

Plot Area: Low Slope/Active Ridge

Species Code

Tree	Shrub	Forb	Grass	Moss
BETUPAP	AMELALN	ACHIMIL	AGROSTO	BRYUPSE
PICEGLA	ARCTUVA	ACTARUB	AGROSUB	CLIMDEN
PINUBAN	CORNSTO	ANEMCAN	AGRYCRI	DREPADU
POPUBAL	LONIDIO	APOCAND	AGRYREP	POHLWAH
POPUTRE	LONIINV	ARABGLA	BROMCIL	RHYTRUG
	PICEGLA	ARALNUD	BROMINE	Notes: Some of the
	POTEFRU	ARENLAT	CALILON	wetter species were
	PRUNVIR	ARETCAM	CARECUR	found in lower
	RIBEOXY	ARTEFRI	CARESIC	depressional areas
	ROSAACI	ASTECIL	DACTGLO	where the willow thicket
	ROSAWOO	CAMPROT	FESTOVI	meets the road. This
	RUBUIDA	CHENALB	FESTSAX	area is very flat and the
	SALIARB	CIRSARV	JUNCBAL	ridge is not readily
	SALIBEB	CORINIT	ORYZHYE	apparent (species found
	SALIDRU	CREPTEC	PHLEPRA	in the area include mint,
	SALIXI	EQUIARV	POAPAL	avens, sedges, nettle, etc.).
	SALIPLA	EQUIFLU	POAPRA	
		EQUIHYE	SCHIPUR	
		EQUIPRA		
		ERYSCHE		
		FRAGVIR		
		GALIBOR		
		GEUMALE		
		HIERUMB		
		LATHOCR		
		MEDISAT		
		MELIALB		
		MELIOFF		
		MENTARV		
		POTEANS		
		POTENOR		

PYROASP
SILECUC
SILENOC
SMILSTE
SOLIGRA
STELLON
STELLON
THALVEN
TRIFHYB
TRIFPRA
TRIFREP
URTIDIO
VICIAME

VEGETATION DESCRIPTION - DEVONSHIRE BEACH

SURVEYORS: NT, VC

AGENCY: Geowest Environmental

DATE: May 17, June 24, 2004, August 12, 2004

Plot Area: On Beach Ridge Slope

Species Code

Tree	Shrub	Forb	Grass	Moss
ABIEBAL	AMELALN	ACHIMIL	AGROREP	AMBLSER
BETUPAP	ARCTUVA	ACTARUB	AGRYSMI	BRACCAM
PICEGLA	CORNSTO	ANEMCAN	CALACAN	BRACSAI
PINUBAN	CORYCOR	ANEMUL	CAREDEW	BRYOMIC
PINUSYL	JUNICOM	APOCAND	CAREFIL	CAMPHIS
POPUBAL	JUNIHOR	ARALNUD	CARESIC	CERAPUR
POPUTRE	LEDUGRO	ARTECAM	ELYMPIP	DREPUNC
	LINNBOR	ASTECIL	FESTSAX	EURHPUL
	LONIDIO	ASTRCIC	FESTSCA	HYLOSP
	LONIINV	COMAUMB	ORYZASP	MNIUSPI
	PRUNPEN	CORNCAN	ORYZPUN	PLAGCUS
	PRUNVIR	DISPTRA	POAPRA	PLEUSCH
	RIBEOXY	ELYMINN		POHLNUT
	RIBETRI	EPILANG		POLYJUN
	ROSAACI	EQUIARV		POLYPIL
	ROSAWOO	EQUIHYE		PYLAPOL
	RUBUIDA	FRAGVIR		SYNTRUR
	SALIBEB	GALIBOR		TETRP
	SALIPLA	GALITRF		THUIABI
	SALISER	GALITRI		TORTMUC
	SYMPALB	GEOCLIV		

VACCMYR GEUMRIV
 VACCVIT LATHOCH
 VIBUEDU MAIACAN
 MELIOFF
 MERTPAN
 MITENUD
 ORTHSEC
 OSMODEP
 PETAPAL
 PLANMAJ
 PROSTRA
 PYROASP
 RUBUPUB
 SMILSTE
 TARAOFF
 THALVEN
 TRIEBOR
 TRIFHYB
 VICIAME
 VIOLADU

CODE	SCIENTIFIC NAME	COMMON NAME
ABIEBAL	<i>Abies balsamea</i> ((L.) Mill)	Balsam fir
ACHIMIL	<i>Achillea millefolium</i> (L.)	Common yarrow
ACHISIB	<i>Achillea sibirica</i> (Ledeb.)	Many-flowered yarrow
ACTARUB	<i>Actaea rubra</i> ((Ait.) Willd.)	Red and white baneberry
AGROPEC	<i>Agropyron pectiniforme</i> (R. & S.)	Crested-wheat grass
AGROREP	<i>Agropyron repens</i> ((L.) Beauv.)	Quack grass
AGROSCA	<i>Agrostis scabra</i> (Willd.)	hair grass
AGROSMI	<i>Agropyron smithii</i> (Rydb.)	Western wheat grass
AGROSTO	<i>Agrostis stolonifera</i> (L.)	Redtop
AGROSUB	<i>Agropyron trachycaulum</i> var. <i>subsecundum</i>	Bearded wheat grass
ALNUTEN	<i>Alnus tenuifolia</i> (Nutt.)	River alder
ALOPAEQ	<i>Alopecurus aequalis</i> (Sobol.)	Water foxtail
AMBLSER	<i>Amblystegium serpens</i>	Moss
AMELALN	<i>Amelanchier alnifolia</i> (Nutt)	Saskatoon
ANEMCAN	<i>Anemone canadensis</i> (L.)	Canada anemone
ANEMUL	<i>Anemone multifida</i> (Poir.)	Cut-leaf anemone
APOCAND	<i>Apocynum androsaemifolium</i> (L.)	Spreading dogbane
ARABGLA	<i>Arabis glabra</i> ((L.) Bernh.)	Tower mustard
ARALNUD	<i>Aralia nudicaulis</i> (L.)	Wild sarsaparilla
ARCTUVA	<i>Arctostaphylos uva-ursi</i> ((L.) Spreng.)	Common bearberry
ARTECAM	<i>Artemisia campestris</i> (L.)	Plains wormwood
ARTEFRI	<i>Artemisia frigida</i> (Willd.)	Pasture sagewort
ASTECIL	<i>Aster ciliolatus</i> (Lindl.)	Lindley's aster

CODE	SCIENTIFIC NAME	COMMON NAME
ASTEHE	<i>Aster hesperius</i> (A. Gray)	Western willow aster
ASTEPUN	<i>Aster puniceus</i> (L.)	Purple-stemmed aster
ASTRCIC	<i>Astragalus cicer</i> (L.)	Cicer milk vetch
BECKSYZ	<i>Beckmannia syzigachne</i> ((Steud.) Fern.)	Slough grass
BETUPAP	<i>Betula papyrifera</i> (Marsh.)	White birch
BRACCAM	<i>Brachythecium campestre</i>	Moss
BRACSA	<i>Brachythecium salebrosum</i>	Moss
BROMCIL	<i>Bromus ciliatus</i> (L.)	Fringed brome
BROMINE	<i>Bromus inermis</i> var. <i>inermis</i>	Awnless brome
BRYOMIC	<i>Bryohaplocladium microphyllum</i>	Moss
BRYUPSE	<i>Bryum pseudotriquetrum</i>	Moss
BRYUSPP	<i>Bryum</i> spp.	Moss
CALACAN	<i>Calamagrostis canadensis</i> ((Michx.) Beauv.)	Bluejoint
CALAIN	<i>Calamagrostis inexpansa</i> (A. Gray)	Northern reed grass
CALALON	<i>Calamovilfa longifolia</i> (Hook.) Scribn.	Sand grass
CAMPNIS	<i>Campyllum hispidulum</i>	Moss
CAMPROT	<i>Campanula rotundifolia</i> (L.)	Harebell
CARDPEN	<i>Cardamine pensylvanica</i> (Muhl)	Bitter cress
CAREBEB	<i>Carex bebbii</i> (Oney ex Fern.)	Bebb's sedge
CARECUR	<i>Carex curta</i> (Good.)	Short sedge
CAREDEW	<i>Carex deweyana</i> (Schwein)	Dewey's sedge
CAREFIL	<i>Carex filifolia</i> (Nutt.)	Thread-leaved sedge
CARESIC	<i>Carex siccata</i> (Dewey)	Hay sedge
CAREVUL	<i>Carex vulpinoidea</i> (Michx.)	Fox sedge
CAREUTR	<i>Carex utriculata</i> (Boott.)	Beaked sedge
CERAPUR	<i>Ceratodon purpureus</i> ((Hedw.) Brid.)	Moss
CHENALB	<i>Chenopodium album</i> (L.)	Lamb's quarters
CICUMAC	<i>Cicuta maculata</i> (L.)	Water hemlock
CIRSARV	<i>Cirsium arvense</i> ((L.) Scop.)	Canada thistle
CLIMDEN	<i>Climacium dendroides</i> ((Hedw.) Web & Mohr.)	Tree Moss
COMAUMB	<i>Comandra umbellata</i> ((L.) Nutt.)	Bastard toad-flax
CONOCON	<i>Conocephalum conicum</i> ((L.) Lindb)	Liverwort
CORINIT	<i>Corispermum nitidum</i> (Kit.)	Bugseed
CORNCAN	<i>Cornus canadensis</i> (L.)	Bunchberry
CORNSTO	<i>Cornus stolonifera</i> (Michx.)	Red-osier dogwood
CORYCOR	<i>Corylus cornuta</i> (Marsh.)	Beaked hazelnut
CREPTEC	<i>Crepis tectorum</i> (L.)	Annual hawk's beard
DACTGLO	<i>Dactylis glomerata</i> (L.)	Orchard grass
DISPTRA	<i>Disporum trachycarpum</i> ((S. Wats.) B.&H.)	Fairybells
DREPADU	<i>Drepanocladus aduncus</i> ((Hedw.) Warnst.)	Brown Moss
DREPUNC	<i>Drepanocladus uncinatus</i> ((Hedw.) Warnst.)	Brown Moss
ELEOACI	<i>Eleocharis acicularis</i> ((L.) R. & S.)	Needle spikerush
ELEOPAL	<i>Eleocharis palustris</i> ((L.) R. & S.)	Creeping spikerush
ELYMINN	<i>Elymus innovatus</i> (Beal.)	Hairy wild rye
ELYMPIP	<i>Elymus piperi</i> (Bowden)	Giant wild rye
EPILANG	<i>Epilobium angustifolium</i> (L.)	Common fireweed

CODE	SCIENTIFIC NAME	COMMON NAME
EPILPAL	<i>Epilobium palustre</i> (L.)	Marsh willowherb
EQUIARV	<i>Equisetum arvense</i> (L.)	Common horsetail
EQUIFLU	<i>Equisetum fluviatile</i> (L.)	Swamp horsetail
EQUIHYE	<i>Equisetum hyemale</i> (L.)	Common scouring-rush
EQUIPRA	<i>Equisetum pratense</i> (Ehrh.)	Meadow horsetail
ERYSCHE	<i>Erysimum cheiranthoides</i> (L.)	Wormseed mustard
EURHPUL	<i>Eurhynchium pulchellum</i> ((Hedw.) Jenn.)	Moss
FESTOVI	<i>Festuca ovina</i> (L.)	Sheep fescue
FESTSAX	<i>Festuca saximontana</i> (Rydb.)	Rocky mountain fescue
FESTSCA	<i>Festuca scabrella</i> (Torr.)	Rough fescue
FRAGVIR	<i>Fragaria virginiana</i> (Duchesne)	Wild strawberry
GALETET	<i>Galeopsis tetrahit</i> (L.)	Hemp-nettle
GALIBOR	<i>Galium boreale</i> (L.)	Northern bedstraw
GALITRF	<i>Galium trifidum</i> (L.)	Small bedstraw
GALITRI	<i>Galium triflorum</i> (Michx.)	Sweet-scented bedstraw
GEOCLIV	<i>Geocaulon lividum</i> ((Richards) Fern.)	Northern comandra
GEUMALE	<i>Geum aleppicum</i> (Jacq.)	Yellow avens
GEUMRIV	<i>Geum rivale</i> (L.)	Purple avens
GLYCGRA	<i>Glyceria grandis</i> (S. Wats. ex A. Gray)	Common tall manna grass
GLYCSTR	<i>Glyceria striata</i> ((Lam.) A.S. Hitchc.)	Fowl manna grass
HIERUMB	<i>Hieracium umbellatum</i> (L.)	Narrow leaved hawkweed
HORDJUB	<i>Hordeum jubatum</i> (L.)	Foxtail barley
HYLOSP	<i>Hylocomium splendens</i> ((Hedw.) B.S.G.)	Stair-step Moss
JUNCALP	<i>Juncus alpinoarticulatus</i> (Chaix.)	Alpine rush
JUNCBAL	<i>Juncus balticus</i> (Willd.)	Wire rush
JUNCNOD	<i>Juncus nodosus</i> (L.)	Knotted rush
JUNIHOR	<i>Juniperus horizontalis</i> (Moench)	Creeping juniper
JUNICOM	<i>Juniperus communis</i> (L.)	Ground juniper
KOCHSCO	<i>Kochia scoparia</i> ((L.) Schrad.)	Summer cypress
LATHOCH	<i>Lathyrus ochroleucus</i> (Hook.)	Cream-colored vetchling
LEDUGRO	<i>Ledum groenlandicum</i> (Oeder.)	Common Labrador tea
LEPTPYR	<i>Leptobryum pyriforme</i>	Moss
LINNBOR	<i>Linnaea borealis</i> (L.)	Twin-flower
LONIDIO	<i>Lonicera dioica</i> (L.)	Twining honeysuckle
LONIINV	<i>Lonicera involucrata</i> ((Richards.) Banks)	Bracted honeysuckle
LUZUMUL	<i>Luzula multiflora</i> ((Retz.) Lej.)	Field woodrush
MAIACAN	<i>Maianthemum canadense</i> (Desf.)	Wild lily-of-the-valley
MEDISAT	<i>Medicago sativa</i> (L.)	Alfalfa
MELIALB	<i>Melilotus alba</i> (Desr.)	White sweet-clover
MELIOFF	<i>Melilotus officinalis</i> ((L.) Lam.)	Yellow sweet clover
MENTARV	<i>Mentha arvensis</i> (L.)	Wild mint
MERTPAN	<i>Mertensia paniculata</i> ((Ait.) G.Don)	Large-flowered lungwort
MITENUD	<i>Mitella nuda</i> (L.)	Bishop's-cap
MNIUSPI	<i>Mnium spinulosum</i>	Moss
MOEHLAT	<i>Moehringia lateriflora</i> ((L.) Fenzl.)	Blunt-leaved sandwort
ORTHSEC	<i>Orthilia secunda</i> ((L.) House)	One-sided wintergreen

CODE	SCIENTIFIC NAME	COMMON NAME
ORYZASP	<i>Oryzopsis asperifolia</i> (Michx.)	White-grained mountain rice grass
ORYZHYE	<i>Oryzopsis hymenoides</i> ((R.&S.) Ricker)	Indian rice grass
ORYZPUN	<i>Oryzopsis pungens</i> ((Torr.) A.S.Hitchc.)	Northern rice grass
PETAPAL	<i>Petasites palmatus</i> ((Ait.) A.Gray)	Palmate-leaved coltsfoot
PETASAG	<i>Petasites sagittatus</i> ((Pursh) A.Gray)	Arrow-leaved coltsfoot
PHALARU	<i>Phalaris arundinacea</i> (L.)	Reed canary grass
PHLEPRA	<i>Phleum pratense</i> (L.)	Timothy
PICEGLA	<i>Picea glauca</i> ((Moench) Voss)	White spruce
PINUBAN	<i>Pinus banksiana</i> (Lamb.)	Jack pine
PINUSYL	<i>Pinus sylvestris</i> var. <i>sylvestris</i> (L.)	Scot's pine
PLAGCUS	<i>Plagiomnium cuspidatum</i> ((Hedw.) Kop.)	Moss
PLANMAJ	<i>Plantago major</i> (L.)	Common plantain
PLEUSCH	<i>Pleurozium schreberi</i> ((Brid.) Mitt.)	Schreber's Moss
POAPAL	<i>Poa palustris</i> (L.)	Fowl bluegrass
POAPRA	<i>Poa pratensis</i> (L.)	Kentucky bluegrass
POHLNUT	<i>Pohlia nutans</i> ((Hedw.) Lindb.)	Copper wire moss
POHLWAH	<i>Pohlia wahlenbergii</i> ((Web.&Mohr) Andr.)	Moss
POLYJUN	<i>Polytrichum juniperum</i> (Hedw.)	Juniper haircap
POLYLAP	<i>Polygonum lapathifolium</i> (L.)	Pale persicaria
POLYPIL	<i>Polytrichum piliferum</i> (Hedw.)	Awed haircap
POPUBAL	<i>Populus balsamifera</i> (L.)	Balsam poplar
POPUTRE	<i>Populus tremuloides</i> (Michx.)	Aspen
POTEANS	<i>Potentilla anserina</i> (L.)	Silverweed
POTEFRU	<i>Potentilla fruticosa</i> (L.)	Shrubby cinquefoil
POTENOR	<i>Potentilla norvegica</i> (L.)	Rough cinquefoil
PRUNPEN	<i>Prunus pensylvanica</i> (L. f.)	Pin cherry
PRUNVIR	<i>Prunus virginiana</i> (L.)	Choke cherry
PYLAPOL	<i>Pylaisiella polyantha</i> ((Hedw.) Grout)	Moss
PYROASA	<i>Pyrola asarifolia</i> (Michx.)	Common pink wintergreen
RHYTRUG	<i>Rhytidium rugosum</i> ((Hedw.) Kindb.)	Pipecleaner moss
RIBEOXY	<i>Ribes oxycanthoides</i> (L.)	Northern gooseberry
RIBETRI	<i>Ribes triste</i> (Pall.)	Wild red currant
ROSAACI	<i>Rosa acicularis</i> (Lindl.)	Prickly rose
ROSAWOO	<i>Rosa woodsii</i> (Lindl.)	Common wild rose
RUBUIDA	<i>Rubus idaeus</i> (L.)	Wild red raspberry
RUBUPUB	<i>Rubus pubescens</i> (Raf.)	Dewberry
RUMEOCC	<i>Rumex occidentalis</i> (S.Wats)	Western dock
SALIBEB	<i>Salix bebbiana</i> (Sarg.)	Beaked willow
SALIBOO	<i>Salix boothii</i> (Dorn)	Booth's willow
SALICAN	<i>Salix candida</i> (Fleugge ex Willd)	Hoary willow
SALIDRU	<i>Salix drummondiana</i> (Barr. ex. Hook)	Satin willow
SALIEXI	<i>Salix exigua</i> (L.)	Sandbar willow
SALILAS	<i>Salix lasiandra</i> (Benth.)	Western shining willow
SALIPET	<i>Salix petiolaris</i> (J.E. Smith)	Basket willow
SALIPLA	<i>Salix planifolia</i> (Pursh)	Flat leaved willow
SALIPRO	<i>Salix prolixa</i> (Anderss.)	Mackenzie's willow

CODE	SCIENTIFIC NAME	COMMON NAME
SALISER	<i>Salix serissima</i> ((Bailey) Fern.)	Autumn willow
SALISIT?	<i>Salix sitchensis</i> (Sanson ex Bong.)	Sitka willow
SCHIPUR	<i>Schizachne purpurascens</i> ((Torr.) Swallen)	Purple oat grass
SCIRMIC	<i>Scirpus microcarpus</i> (Presl)	Small fruited bulrush
SCIRVAL	<i>Scirpus validus</i> (Vahl)	Common great bulrush
SCUTGAL	<i>Scutellaria galericulata</i> (L.)	Marsh skulicap
SILECUC	<i>Silene cucubalus</i> (Wibel)	Bladder campion
SILENOC	<i>Silene noctiflora</i> (L.)	Night-flowering catchfly
SISYMON	<i>Sisyrinchium montanum</i> (Greene)	Common blue-eyed grass
SMILSTE	<i>Smilacina stellata</i> (L.) Desf.)	Star-flowered Solomon's seal
SOLICAN	<i>Solidago canadensis</i> (L.)	Canada goldenrod
SOLIGRA	<i>Solidago graminifolia</i> (L.) Salisb.	Flat- topped goldenrod
STELLON	<i>Stellaria longifolia</i> (Muhl.)	Long-leaved chickweed
SYMPALB	<i>Symphoricarpos albus</i> ((L.) Blake)	Snowberry
SYNTRUR	<i>Syntrichia ruralis</i>	Moss
TARAOFF	<i>Taraxacum officinale</i> (Weber)	Dandelion
TETRPOL	<i>Tetraphis pellucida</i> (Hedw.)	Moss
THALVEN	<i>Thalictrum venulosum</i> (Trem.)	Veiny meadow rue
THUIABI	<i>Thuidium abietinum</i> ((Hedw.) B.S.G.)	Moss
TORTMUC	<i>Tortula mucronifolia</i>	Moss
TRIEBOR	<i>Trientalis borealis</i> (Raf.)	Northern starflower
TRIFHYB	<i>Trifolium hybridum</i> (L.)	Alsike clover
TRIFPRA	<i>Trifolium pratense</i> (L.)	Red clover
TRIFREP	<i>Trifolium repens</i> (L.)	White clover
TYPHLAT	<i>Typha latifolia</i> (L.)	Common cattail
URTIDIO	<i>Urtica dioica</i> (L.)	Common nettle
VACCMYR	<i>Vaccinium myrtilloides</i> (Michx.)	Blueberry
VACCVIT	<i>Vaccinium vitis-idaea</i> (L.)	Bog cranberry
VIBUEDU	<i>Viburnum edule</i> ((Michx.) Raf.)	Low-bush cranberry
VICIAME	<i>Vicia americana</i> (Muhl.)	American vetch
VIOLADU	<i>Viola adunca</i> (J.E. Smith)	Early blue violet

Appendix 2 – Rare Plant Population Locations

Species	Easting	Northing
<i>Carex vulpinoidea</i>	642861	6136087
<i>Salix sitchensis</i>	642727	6134626

Appendix 3 – Map of Joyce Gould's June 2004 Survey Results



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